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Abstract

In the Spring of 2003, a series of dispersion field experiments (Joint Urban 2003) were conducted at Oklahoma City. These experiments were complimentary to the URBAN 2000 field studies at Salt Lake City (Allwine, et. al, 2002) in that they will provide a second set of comprehensive field data for evaluation of CFD as well as for other dispersion models. In contrast to the URBAN 2000 experiments that were conducted entirely at night, these new field studies took place during both daytime and nighttime thus including the possibility of convective as well as stable atmospheric conditions. Initially several CFD modeling studies were performed to provide guidance for the experimental team in the selection of release sites and in the deployment of wind and concentration sensors. Also, while meteorological and concentration measurements were taken over the greater Oklahoma City urban area, our CFD calculations were focused on the near field of the release point. The proximity of the source to a large commercial building and to the neighboring buildings several of which have multi-stories, present a significant challenge even for CFD calculations involving grid resolutions as fine as 1 meter.

A total of 10 Intensive Observations Periods (IOP's) were conducted within the 2003 field experiments. SF_6 releases in the form of puffs or continuous sources were disseminated over 6 daytime and 4 nighttime episodes. Many wind and concentration sensors were used to provide wind and SF_6 data over both long and short time-averaging periods. In addition to the usual near surface measurements, data depicting vertical profiles of wind and concentrations adjacent to the outside walls several building were also taken. Also of interest were observations of the trajectory of balloons that were released closed to the tracer release area. Many of the balloons released exhibit extremely quick ascents up from ground level to the top of buildings, thus implying highly convective conditions.

In this paper we will present some simulations that were performed during the planning of the field experiments. The calculations were based on two possible release sites at the intersections of Sheridan and Robinson, and Broadway and Sheridan. These results provided initial information on flow and dispersion patterns, which were used to guide optimal placement of sensor at appropriate locations. We will also discuss results of more recent simulations for several releases in which reliable data is available. These simulations will be compared with the near field data taken from the wind sensors as well as the time-averaged data from the concentration sensors. Among the other topics discussed are initial and boundary conditions used in the simulations, adaptation of building GIS data for CFD modeling and analysis of field data.

References

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